

WS301

Magnetic Contact Switch

User Guide

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Chapter 1. Preface

Copyright Statement

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Milesight reserves the right to change this guide and the specifications without prior notice. The latest specifications and user documentation for all Milesight products are available on our official website http://www.milesight.com

Safety Instruction

These instructions are intended to ensure that users can use the product correctly to avoid danger or property loss. Milesight will not take responsibility for any loss or damage resulting from failure to follow the instructions in this operating guide.

CAUTION:
Injury or equipment damage may be caused if any of these cautions are neglected.

- The device must not be remodeled in any way.
- In order to protect the security of the device, please change device the password when first configuration. The default password is 123456.
- Do not place the device close to objects with naked flames.
- Do not place the device where the temperature is below/above the operating range.
- Make sure electronic components do not drop out of the enclosure while opening.
- The device must never be subjected to shocks or impacts.

Revision History

Release Date	Version	Description
Apr. 13, 2021	V 1.0	Initial version
June 30, 2021	V 1.1	Delete power button features.

Release Date	Version	Description
Dec.9, 2021	V 1.2	1. Add Milesight D2D controller feature; 2. Delete low power alarm interval, device only uplinks once when battery level drops to 1%.
Jan.13, 2023	V 1.3	1. Add Single-Channel mode; 2. Add Milesight D2D LoRa Uplink feature.
Apr. 22, 2026	V1.4	Magnet component optimization.

Chapter 2. Product Introduction

This chapter describes basic product information.

Overview

Milesight WS301 simply enables you to know when someone enters the office/building through door/window or something has been moved. The minimal magnet is placed inside the portable part, while the sensor is inside the fixed part that can be attached on door/window or other objects. With LoRa technology, one of the most low power consumption technologies, Milesight WS301 can work up to almost 5 years without bothering to replace battery. Compliant with Milesight LoRaWAN® gateway and Milesight Development Platform, WS301 will surely monitor the real-time open/close status and receive alarms.

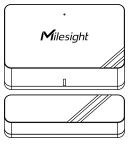
With a style of minimalism and compact size, the wire-free WS301 can be easily mounted on the doors, panes, or cabinets, greatly providing real applications for smart homes, smart office or smart factories.

The device has the following features:

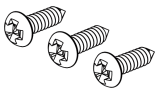
- Suitable for various doors/windows of different materials
- Support mounting tamper detection
- LED for network status, open/close status, tamper and low battery indication
- Ultra-wide-distance transmission up to line of sight of 15 km
- Built-in 1200 mAh replaceable battery can work continuously for more than 5 years
- Equipped with NFC for one touch configuration
- Support Milesight D2D protocol to enable ultra-low latency and directly control without gateway
- Function well with standard LoRaWAN® gateways and network servers
- Compliant with Milesight IoT Cloud and Milesight Development Platform

Packing List

This section describes the packing list. After unboxing, please check that the following items are included in the package. If any of the below items are missing or damaged, please contact your sales representative.



1 × WS301 Device



3 × Mounting Screws



1 × Warranty Card

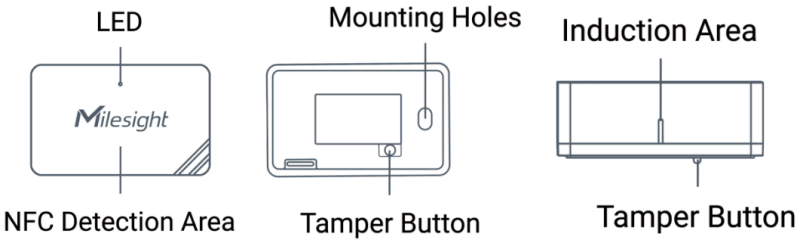


1 × Quick Guide Card

Hardware Introduction

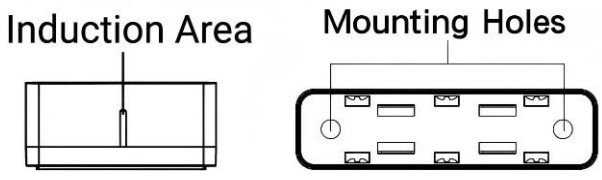
Hardware Overview

Sensor



Part	Description
NFC Detection Area	Enables wireless configuration via Milesight ToolBox App.
LED	Indicates the device status.
Mounting Holes	Used for securing the device.
Tamper Button	Used to detect tampering or removal of the device.
Induction Area	Used to detect the status of doors/windows

Magnet



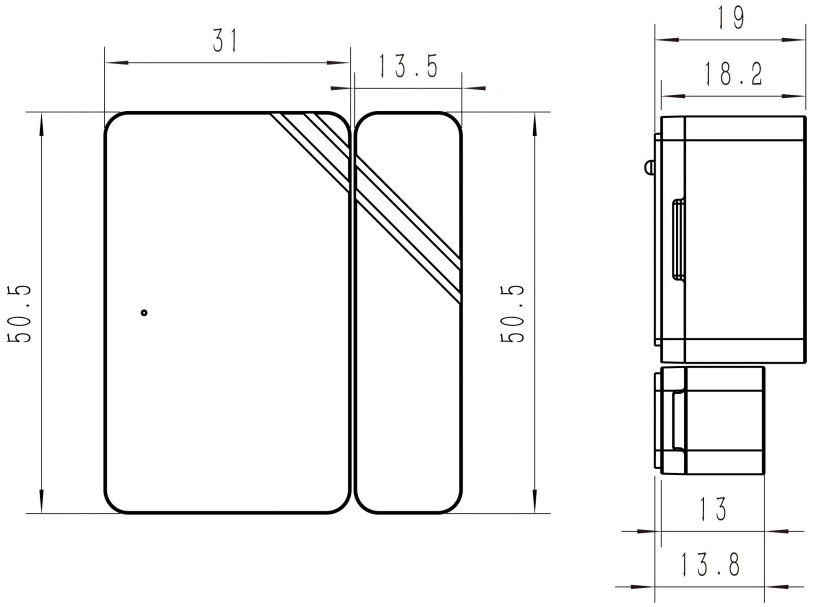
Part	Description
Induction Area	Used to detect the status of doors/windows.
Mount-ing Holes	Used for securing the device.

LED Indicator Descriptions

Function	Action	LED Indicator
Door/Window Status	Switch On/Off (network unregistered)	Red, blinks once
	Switch On/Off (network registered)	Green, blinks once
Network Status	Send join network requests	Red, blinks once
	Joined the network successfully	Green, blinks twice
Tamper Detection	The device is un-installed (tamper is detected)	Red, blinks once
	The device is installed	Green, blinks once
Reboot	Press and hold the reset button (internal) for more than 3 seconds	Slowly blinks
Reset to Factory Default	Press and hold the reset button (internal) for more than 10 seconds	Quickly blinks

Dimensions

The following figure shows the device dimensions (unit: mm).



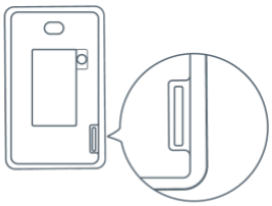
Chapter 3. Power Supply

Remove the Insulation

The device has built-in battery installed by default. Before using the device, please follow the steps below to remove the battery insulation sheet.

Steps:

1. Pull out the battery insulating sheet to power on the device.
2. Confirm that the indicator light turns green and remains on for 3 seconds.



Replace the Battery

This section describes how to replace the batteries when the device runs out of power.

Prerequisites:

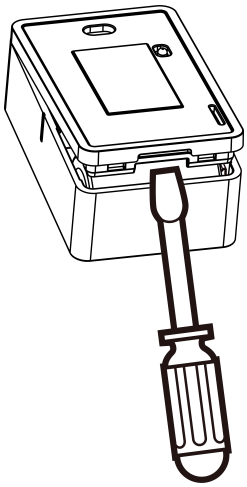
- Flat Screwdriver

Battery Requirements:

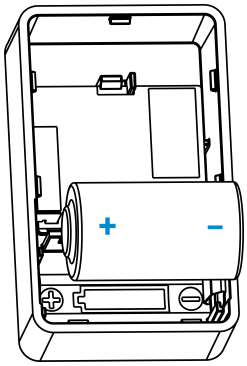
- The device can only be powered by ER14250 Li-$SOCl_2$ battery not alkaline battery.
- Always replace with new batteries. Using old batteries may reduce battery life or lead to inaccurate power level calculations.
- Remove battery from the device if it is not used for an extended period.

Steps:

1. Remove the back cover.



2. Replace the battery correctly, ensuring proper orientation and model compatibility.



3. Reattach the back cover.

Chapter 4. ToolBox App Configuration

The Milesight ToolBox app can be used to configure the device. This chapter describes ToolBox related configuration.

Access the Device Using NFC

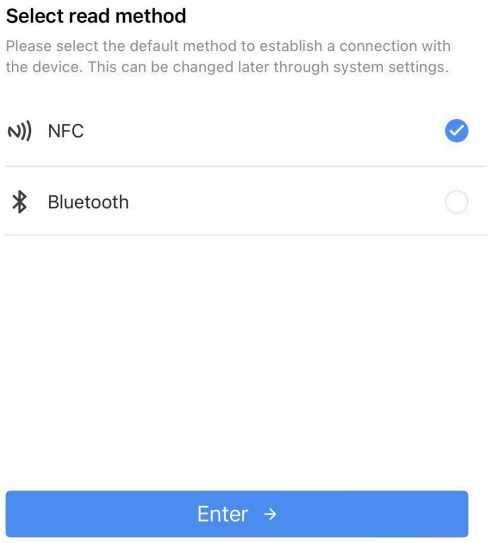
This section describes how to access the device using NFC.

Prerequisites: The device is powered by internal or external power source.

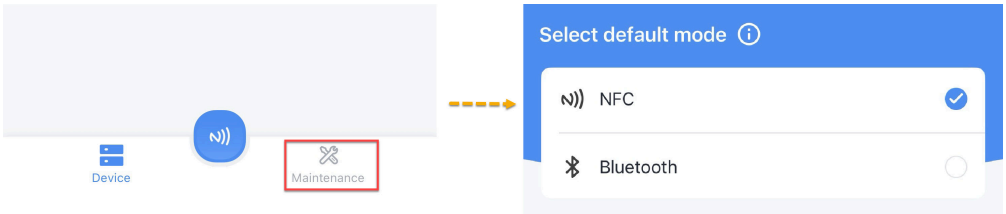
Steps:

1. Download Milesight ToolBox app from Google Play or Apple Store.
2. Enable the NFC function on the smart phone.
3. Launch ToolBox.

    a. Upon initial launch, the following page will appear. Select **NFC** and click **Enter**.

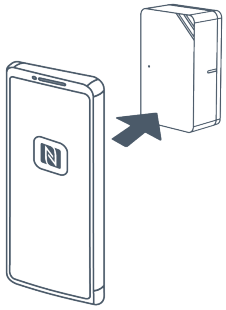


    b. Upon subsequent launches, Click **Maintenance** on the home page, and then select **NFC**.



4. (Optional) To locate the NFC detection areas of the phone and the device, click **Can't find the NFC location**.
5. Put the NFC detection area of the phone close to the NFC antenna of the device.

> **Tip:**
> It is recommended to remove the phone case.



6. Click . If the device is recognized successfully, the homepage is displayed.

> **Troubleshooting:**
> If read fails, move the phone away and reposition it close to the sensor to try again.

For a description of the homepage, refer to the following table.

Item	Description
Basic Information	Show basic device information and sync the device time.
Setting	Set the device and network parameters.
	Import, add, export or delete a template.
	Select language, show NFC positions, check App version, etc..

Configure LoRaWAN® Parameters

This section describes how to configure the device transmission parameters for the LoRaWAN® network.

Usually, it consists of the below steps:

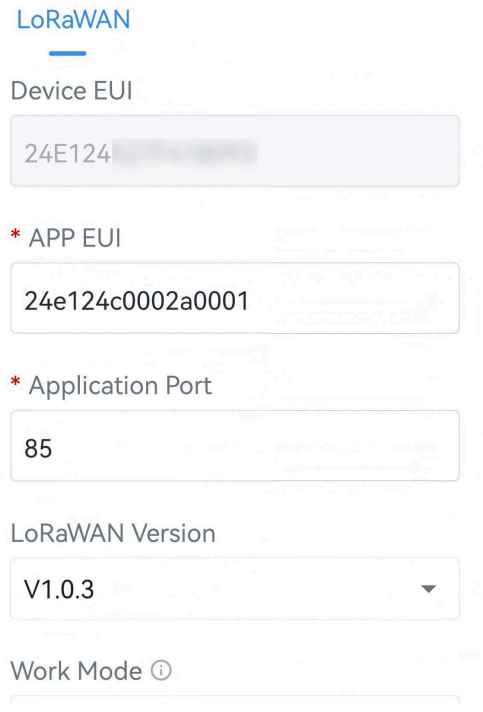
1. Configure Join Type and Supported Frequency (Necessary)
2. Configure Other LoRaWAN® Parameters (Optional)

Configure Join Type and Frequency

It is necessary to configure the join type and the frequency to establish communication with LoRaWAN® gateways.

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.



3. From the **Join Type** selection box, select **OTAA** or **ABP** as needed.

> **Note:**
> OTAA is required if you connect the device to the Milesight Development Platform.

4. Configure **Join Type** related parameters as needed. You can use default values unless otherwise specified.

◦ If **OTAA** is selected, configure **Application Key** and **Rejoin Mode** as needed. For details, refer to the following table.

Parameter	Description
Application Key	Appkey for OTAA mode. Default: **Device EUI + Device EUI**. Example: 24e124123456789024e1241234567890. **Tip:** Contact sales before purchase if you need random App keys.
Rejoin Mode	Rejoin mode for OTAA mode. Reporting interval≤35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval or every other reporting interval to verify connectivity. Reporting interval > 35 minutes: The device sends a specific number of LinkCheckReq MAC packets at each reporting interval to validate connectivity. If there is no response, the device will re-join the network. When **Rejoin Mode** is enabled, enter a number in the **Set the number of detection signals sent** text box. The actual sending number is the configured number +1.

◦ If **ABP** is selected, configure **Network Session Key**, **Application Session Key** and **Device Address** as needed. For details, refer to the following table.

Parameter	Description
Network Session Key	Nwkskey for ABP mode. Default: **5572404C696E6B4C6F52613230313823**.
Application Session Key	Appskey for ABP mode. Default: **5572404C696E6B4C6F52613230313823**.
Device Address	DevAddr for ABP mode. Default: 5^{th} to 12^{th} digits of SN.

5. Select a frequency from the **Support Frequency** selection box as needed. This must be the same as the frequency configured on the gateway's web GUI.

- If the **Supported Frequency** is **CN470**, **US915** or **AU915**, enter the channel index(es) separated by commas.

  Examples:

  1, 40: Enabling Channel 1 and Channel 40
  1-40: Enabling Channel 1 to Channel 40
  1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60
  All: Enabling all channels
  Null: All channels are disabled

  > **Tip:**
  > Set the **Channel Index** to **8-15** when connecting to a Milesight LoRaWAN® gateway with default settings.

- If the **Supported Frequency** is **AS923**, select a channel plan and enable the frequencies as needed.
- If the **Supported Frequency** is any option other than those listed above, enable the frequencies as needed.

6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.

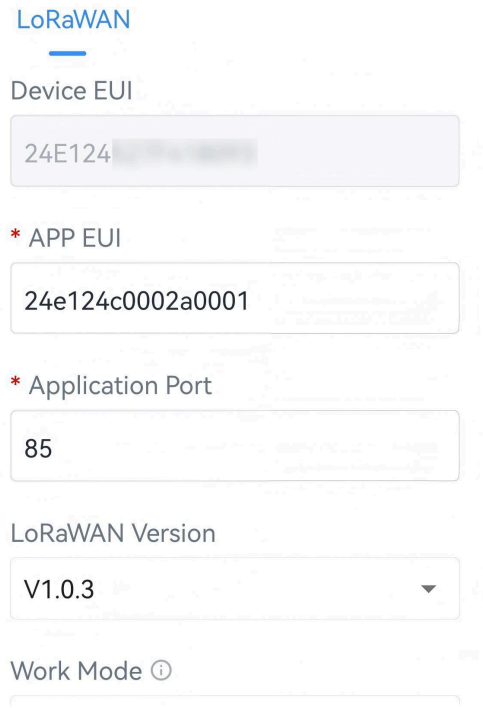


Write successfully!

Configure Other LoRaWAN® Parameters

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. Navigate to the **LoRaWAN** page The **LoRaWAN** page is displayed, see the following figure.



3. Configure the following parameter as needed. You can use default values unless otherwise specified. For a description of the parameters, refer to the following table.

Parameter	Description
Device EUI	Unique ID of the device labelled on the device housing. **Tip:** For bulk deployments, contact sales to request the device EUI list.
App EUI	The default App EUI (join EUI) is 24E124C0002A0001.
Application Port	Port used for sending and receiving data. Default: **85**.
LoRaWAN® Version	Options: **V1.0.2**, **V1.0.3**.
Work Mode	It is fixed as Class A.
Confirmed Mode	If the device does not receive ACK packet from network server, it will re-send data once.
Join Type	Refer to Configure Join Type and Supported Frequency.

Parameter	Description
Supported Frequency	Refer to Configure Join Type and Supported Frequency.
Channel Mode	Select Standard-Channel mode or Single-Channel mode. When Single-Channel mode is enabled, only one channel can be selected to send uplinks.
ADR Mode	Enables the network server to adjust the spreading factor, the bandwidth and the transmission power to optimize data rates, airtime and energy consumption in the network.
Spreading Factor	If ADR mode is disabled, the device sends uplink data using this spreading factor. A higher spreading factor increases transmission range but reduces data rate and increases power consumption. This parameter varies with **Supported Frequency**.
Tx Power	Defined by the LoRa Alliance. Specifies the strength of the radio signal transmitted by the device.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz

4. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

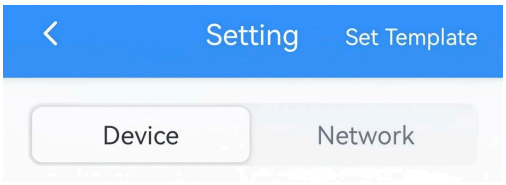
Configure General Parameters

This section describes how to configure the general parameters of the device, which includes:

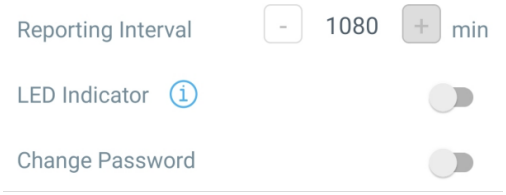
- Reporting Interval
- LED Indicator
- Change Password

Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Device** tab.



3. In the **General** page, configure the following device parameters as needed.



Parameter	Description
Reporting Interval	Reporting interval of magnet, tamper and battery level to network server. Default: 1080mins, Range: 1 - 1080 mins. **Note:** WS301 will also transmit alarm when magnet or tamper status changes.
LED Indicator	Enable or disable the light indicating. **Note:** The indicator of reset feature is not allowed to disable.
Change Password	Change the password for ToolBox App to write this device.

4. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Related information

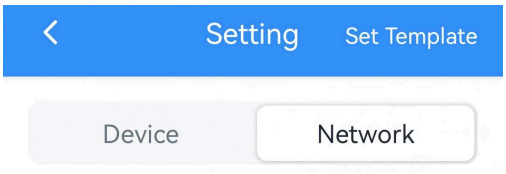
Commands for General Setting

Configure Milesight D2D Parameters

Milesight D2D protocol is developed by Milesight and used for setting up transmission among Milesight devices without gateway. When the Milesight D2D settings is enabled, the device can work as a D2D controller to send control commands to trigger Milesight D2D agent devices.

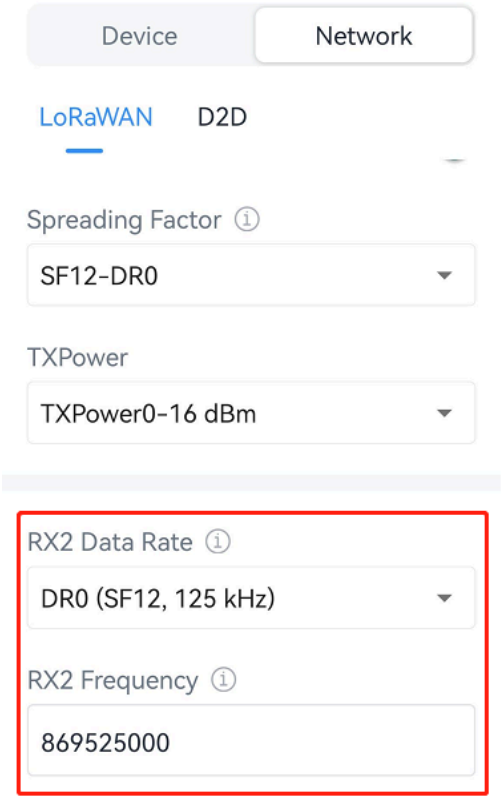
Steps:

1. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
2. On the top bar, select **Network** tab.

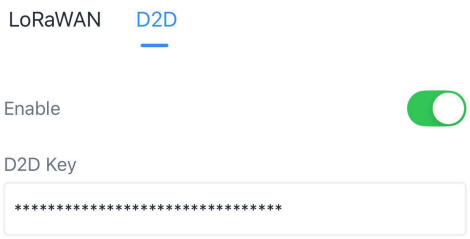


3. Configure the **RX2 Data Rate** and **RX2 Frequency** to be the same as the settings of Milesight D2D controller.

> **Tip:**
> It is suggested to change the default values if there are many LoRaWAN® devices around.



4. Click **D2D**. Enable Milesight D2D feature and define a unique D2D key that is the same as Milesight D2D controller. (Default D2D key: 5572404C696E6B4C6F52613230313823).



5. Enable a WS301 status and configure a 2-byte hexadecimal command (This command is pre-defined in Milesight D2D agent device). When the device detects this status, it will send the control command to corresponding Milesight D2D agent devices.

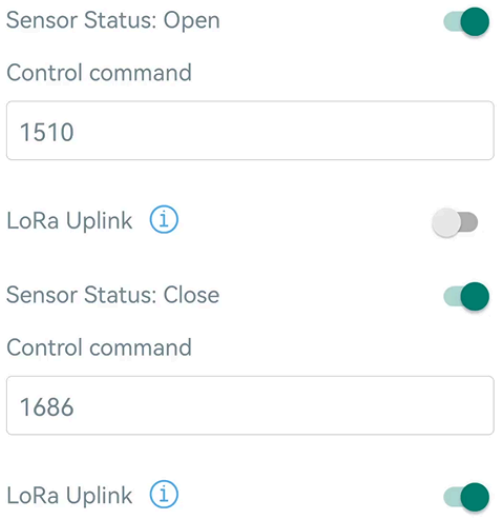
Note:
If you enable **LoRa Uplink**, a LoRaWAN® uplink packet that contains corresponding alarm status will be sent to gateway after the Milesight D2D command packet. Otherwise, the alarm packet will not send to LoRaWAN® gateway.

6. Click **Write** in the lower right corner, and put the NFC detection area of the phone close to the NFC antenna of device. If the configuration succeeds, the following page is displayed.



Write successfully!

Example: When WS301 detects the sensor status is open, it will send the command 1510 to Milesight D2D agent devices. When WS301 detects the sensor status is close, it will send the command 1686 to Milesight D2D agent devices.



Maintain the Device

This section describes how to maintain the device.

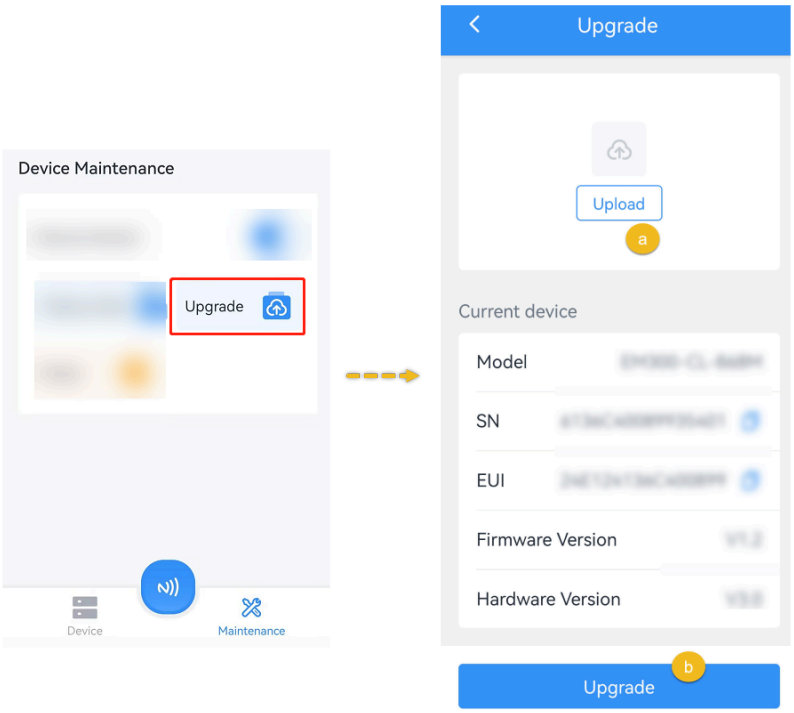
Upgrade the Device

This section describes how to upgrade the device locally.

Prerequisites: Download firmware from Milesight official website and save it to the smart phone. It is recommended to consult technical support before upgrading to ensure a safe and successful upgrade.

Steps:

1. On the homepage of ToolBox, click **Maintenance** in the lower right corner.
2. Click **Upgrade** to go to **Upgrade** page.
3. Click **Upload** to select the firmware from the local path of the smartphone.
4. Click **Upgrade** to upgrade the device.



5. Put the NFC detection area of the phone close to the NFC antenna of device for a few minutes.

> **CAUTION:**
> Any operation on ToolBox is not allowed during upgrading, otherwise the upgrading will be interrupted, or even the device will break down.

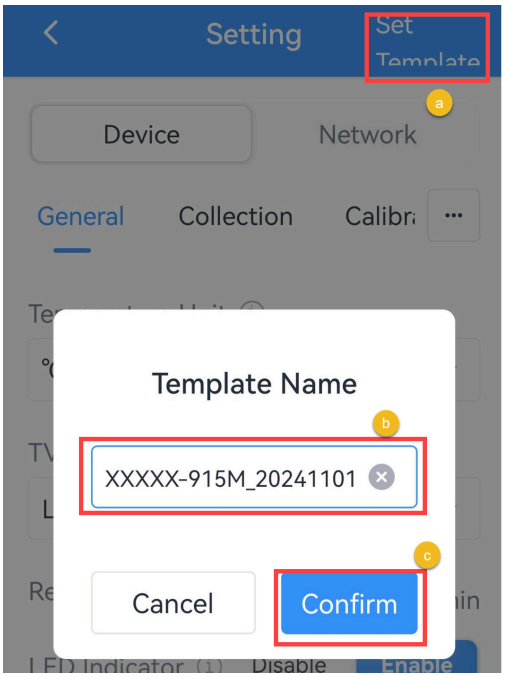
Configure a Template for Configuration Backup

This device supports configuration backup, which enables quick and easy batch configuration. This section describes how to backup the device configuration and write to other devices.

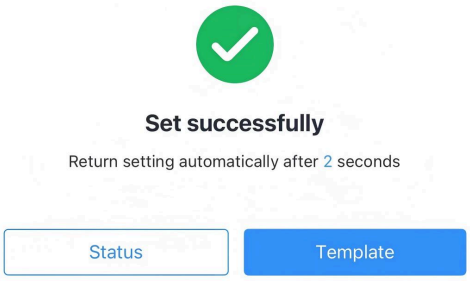
Prerequisites: The backup device and the device importing the backup are exactly the same model.

Step 1. Set a Template

1. Access the device via ToolBox App.
2. On the homepage of ToolBox, click **Setting** to enter the **Setting** page.
3. Edit the device parameters as required, click **Set Template** in the top right corner.
4. Customize a template name, click **Confirm** to save the current configuration as a template.

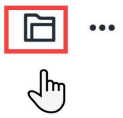


5. If the save is successfully, the following page is displayed. The template will be saved to the ToolBox App.

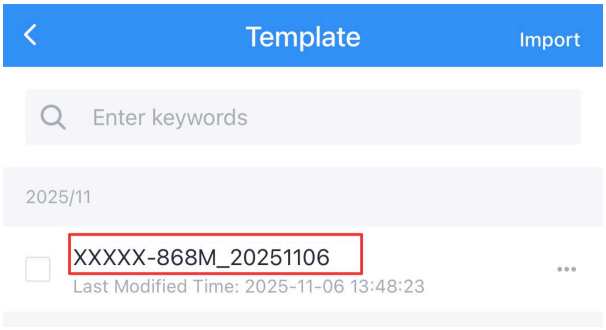


Step 2. Write Template Configuration to the Target Device

1. On the homepage of ToolBox, click **Device** in the lower left corner.
2. Click Template icon in the top right corner to go to **Template** page.



3. Click the saved template. Do not select the template.



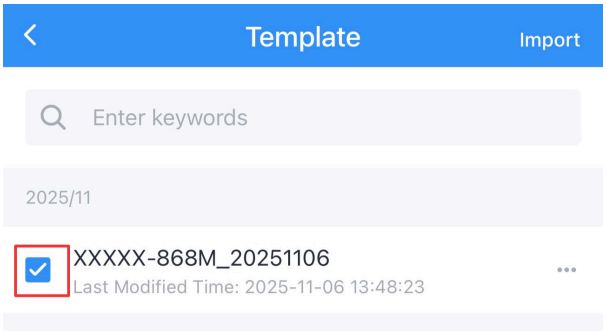
4. In the displayed page, click **Write** in the bottom and put the NFC detection area of the phone close to the NFC antenna of the target device. If the configuration is written to the target device, the following page is displayed.



Write successfully!

Step 3. Export or Delete a Template (Optional)

1. Select the checkbox of the target template as shown in the following figure.



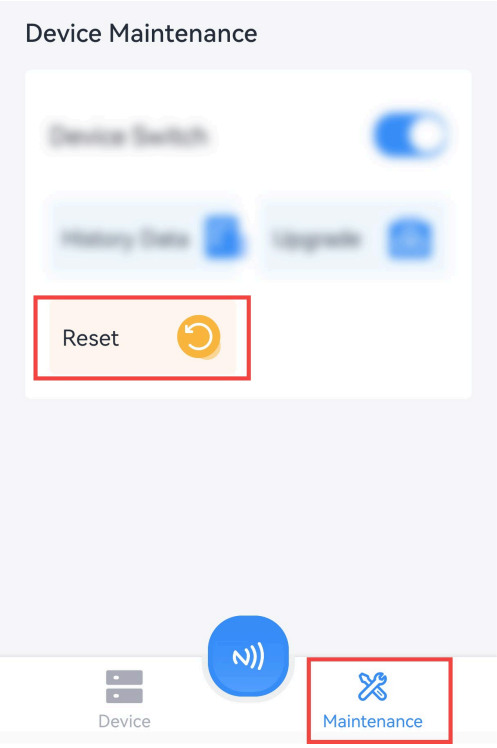
2. Click **Export** in the lower left cornet to export this template as a JSON format file and save it to the smart phone.
3. Click **Delete** in the lower right corner, then click **Confirm** to delete this template from ToolBox.

Reset the Device

This section describes how to reset the device.

Steps:

1. On the homepage of ToolBox, click **Maintenance** in the lower right corner. The **Maintenance** page is displayed, see the following figure.



2. Click **Reset**.
3. In the displayed dialog box, click **Confirm**.
4. Put the NFC detection area of the phone close to the NFC antenna of the device.

If the device is successfully reset, the following page is displayed.



Reset successfully!

Note:

If unable to read or write devices normally using the ToolBox, perform a hardware reset.

Chapter 5. Install the Device

Installation Requirement

In order to ensure the best detection, please install the device as follows:

- Make sure the magnet part is placed inside the door (portable part) and sensor is inside the door frame (fixed part). For double doors, put every part on each door.
- The notched side of magnet should face the notched side of sensor, otherwise it may affect the sensitivity of on/off detection.
- The plane distance between sensor and magnet should not be more than 20mm, and the height difference should be less than 20mm.

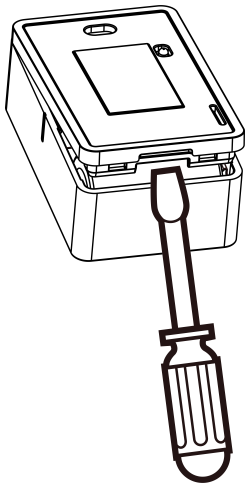
Wall Screw Mounting

Prerequisites:

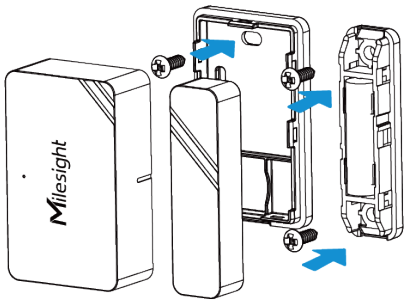
- Wall Screw Mounting Kits
- Screw Caps
- Electric Drill
- Flat Screwdriver

Steps:

1. Using a flathead screwdriver, gently pry open the back covers of the main unit and the magnetic part, as shown below.



2. Screw the covers on the mounting positions.
3. Install back the devices.



3M Tape Mounting

Prerequisites:

- 3M Tape

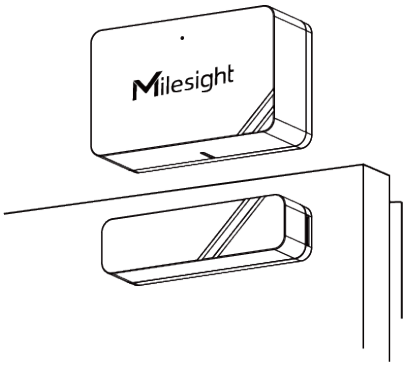
Requirements:

To ensure the devices are securely installed and prevent them from falling due to adhesive peeling, please strictly adhere to the following requirements.

- The mounting surface must be dry, smooth, firm, and free of oil, dust, or dirt.
- Do not mount on rough, damp, dusty, greasy surfaces, or those covered with soft materials such as wallpaper or fabric.
- Clean the surface with alcohol before mounting; avoid touching the adhesive side.
- Recommended application temperature: 20~40°C. In low temperatures, pre-warm the tape to approx. 30°C.
- After mounting, press firmly for at least 30 seconds to ensure full contact.
- Allow 24 hours of curing time before use.
- If the surface is unsuitable or long-term use in low temperatures is required, use screw fixing instead.

Steps:

1. Apply 3M tape to the back of the sensor and magnet, avoiding contact with the adhesive.
2. Remove the liner, position the sensor and magnet on the door or desired surface.
3. Press firmly as described above.



Chapter 6. Uplink Packets and Downlink Commands

This chapter describes that uplink data packet and downlink commands supported by the device.

All messages follow the following format (HEX), the Parameter/Data field must follow **little-endian** byte order:

Command ID	Parameter/Data	...
N Bytes	0-N Byte	...

For decoder and encoder examples, please find files on https://github.com/Milesight-IoT/SensorDecoders. For details of uplink reports and downlink commands please refer to the sections below.

Uplink Packets

This section describes the uplink packets reported by the device.

Basic Information Packet

After joining the network, the device reports a packet containing the basic device information.

Packet description:

Item	Channel	Type	Byte	Description
Power On	ff	0b	1	Device is on
Protocol Version	ff	01	1	Example: 01=V1
Hardware Version	ff	09	2	Example: 03 10 = V3.1
Software Version	ff	0a	2	Example: 03 01 = V3.1
Device Type	ff	0f	1	00: Class A, 01: Class B, 02: Class C, 03: Class C to B
Serial Number	ff	08	6	12 digits

Example:

ff0bff ff0101 ff086538b2232131 ff090100 ff0a0102 ff0f00		
Channel	**Type**	**Value**
ff	0b	Power On: ff(Reserved)
ff	01	Protocol Version: 01=V1
ff	08	Serial Number: 6538b2232131
ff	09	Hardware Version: 0100=V1.0
ff	0a	Software Version: 0102=V1.2
ff	0f	00: Class A

Periodic Data Packet

The device reports a data packet at a configured reporting interval.

Packet description:

Item	Channel	Type	Byte	Description
Battery Level	01	75	1	UINT8, Unit: %
Magnet Status	03	00	1	00=>Switch close, 01=>Switch open
Tamper Status	04	00	1	00=>Device is installed 01=>Device is un-installed

Example:

01 75 64 03 00 00 04 00 01		
Channel	**Type**	**Value**
01	75	Battery Level: 64 => 100%
03	00	Magnet Status: 00 => Switch close
04	00	Tamper Status: 01=>Device is un-installed

Alarm Report

The device reports the following types of alarm packets.

Packet description:

Item	Channel	Type	Byte	Description
Battery Level	01	75	1	UINT8, Unit: %
Magnet Status	03	00	1	00=>Switch close, 01=>Switch open
Tamper Status	04	00	1	00=>Device is installed 01=>Device is un-installed

Examples:

1. Low battery alarm: Report once when battery level drops to 1%.

017501		
Channel	**Type**	**Value**
01	75	Battery Level: 01 => 1%

2. Magnet alarm: Report once when the magnet or tamper status changes.

01 75 64 03 00 00 04 00 01		
Channel	**Type**	**Value**
01	75	Battery Level: 64 => 100%
03	00	Magnet Status: 00 => Switch close
04	00	Tamper Status: 01=>Device is un-installed

Downlink Commands

Downlink commands can be used for remote control of device through a network server. The downlink port (application port) is 85 by default and can be configured through ToolBox.

For details of downlink commands please refer to the sections below.

Commands for General Setting

The device supports multiple commands for general settings.

Command description:

Item	Channel	Type	Byte	Description
Reboot	ff	10	1	ff
Report Interval	ff	03	2	UINT16, Unit: s

Example:

1. Reboot the device.

ff10ff

2. Set report interval as 20 minutes.

ff03b004		
Channel	**Type**	**Value**
ff	03	b004=>04b0=1200s=20 minutes

Related information

Configure General Parameters

Chapter 7. Services

Milesight provides customers with timely and comprehensive technical support services. End-users can contact their local dealer to obtain technical support. Distributors and resellers can contact Milesight directly for technical support.

Technical Support Mailbox: iot.support@milesight.com

Online Support Portal: https://support.milesight-iot.com

Resource Download Center: https://www.milesight.com/iot/resources/download-center/

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